

### Liquid astronomy

JSC employees have completed a new liquid mercury telescope that will eye orbital debris. Story on Page 3.



### Flood relief

JSC employees contribute to the flood relief effort by donating clothes, food, and other useful items. Photo on Page 4.

# Space News Roundup

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## Scientists use *Atlantis* to study atmosphere

### Astronauts practice new rendezvous that will be used in Mir approaches

By Rob Navias

Scientists will use information gathered on the STS-66 Atmospheric Laboratory for Applications and Science-3 mission to enrich their knowledge about the natural and human-induced changes in the Earth's atmosphere.

The flight was scheduled to lift off at 10:56 a.m. CST Thursday, carrying Commander Don McMonagle, Pilot Curt Brown, Payload Commander Ellen Ochoa, Mission Specialists Scott Parazynski, Joe Tanner and Jean-Francois Clervoy on an 11 day mission.

Early this morning, Clervoy was scheduled to use *Atlantis*' 50-foot long robot arm to deploy

the CRISTA-SPAS, or Cryogenic Infrared Spectrometers and Telescopes for the Atmosphere and its Shuttle Pallet Satellite, for eight days of free-flying research.

The 3 1/2 ton satellite will use a variety of spectrometers and telescopes to measure the amount of infrared radiation emitted from the middle atmosphere. That data will be correlated with the information gleaned from the ATLAS-3 instruments to offer scientists a broad base of knowledge about the chemistry of the Earth's upper



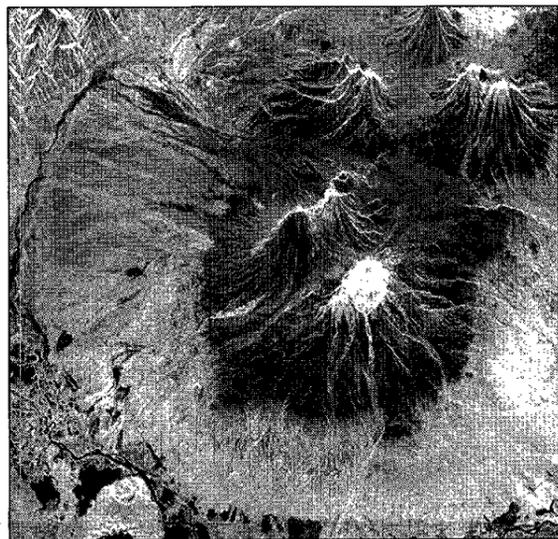
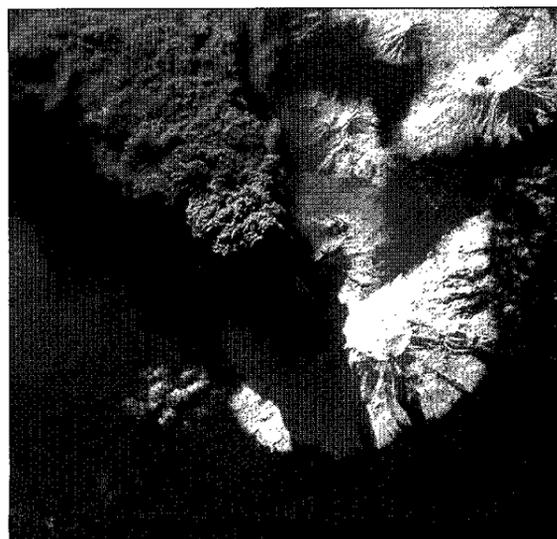
atmosphere, and change that have occurred since the ATLAS-2 mission in April 1993.

After eight days of science-gathering for CRISTA-SPAS at a distance of about 40 nautical miles from *Atlantis*, McMonagle and Brown will close in on the satellite for its retrieval, utilizing an "R-bar" approach from below for the first time during the final stage of the rendezvous. This technique will be used next year when *Atlantis* edges toward the Russian Mir Space Station for the first docking

with Mir. The "R-bar" rendezvous is designed to save propellant and to minimize jet thruster impingement on the Mir's solar panels during next year's rendezvous activity. When *Atlantis* is within 30 feet of CRISTA-SPAS, Ochoa will extend the robot arm and grapple the satellite to complete its mission.

McMonagle, Ochoa and Tanner comprise the red team, or daytime shift aboard *Atlantis*, while Brown, Clervoy and Parazynski make up the blue team, or overnight shift. Ochoa and Parazynski are responsible for the operation of the ATLAS instruments.

Please see STS-66, Page 4



This comparison shows optical, left, and radar imaging of the Kiliuchevskoi volcano in Kamchatka, Russia. The radar image was recorded by the Spaceborne Imaging Radar C/X-Band Synthetic Aperture Radar, while the optical photo was taken by shuttle astronauts during the early hours of the eruption on Sept. 30. The ash plume, which reached heights of more than 50,000 feet, is emerging from a vent on the north flank of Kiliuchevskoi, partially hidden by the plume and its shadow in this view. The photograph is oriented with north toward the bottom, for comparison with the radar image at right acquired a few days later.

NASA Images

## Geologists compare SRL images

Geologists are using radar images and photographs taken during NASA's most recent shuttle mission to study possible new lava flows from Mt. Kiliuchevskoi on Russia's Kamchatka peninsula.

"The *Endeavour* astronauts were among the first witnesses to the eruption, which began only eight hours after the launch on Sept. 30," said Dr. Jeffrey Plaut of NASA's Jet Propulsion Laboratory. "The crew tracked the progress of the eruption daily, providing us with the most detailed documentation of a large eruption ever obtained from orbit."

Plaut discussed the dramatic radar imagery in a presentation to this year's meeting of the Geological Society of America in Seattle. Plaut is the geology experiment representative for the Spaceborne Imaging

Radar C/X-Band Synthetic Aperture Radar, the international radar system carried into orbit for 11 days by *Endeavour*. Plaut compared the radar data to the optical photographs of the massive eruption that were taken by the astronaut crew.

The Kamchatka volcanoes are among the most active volcanoes in the world. The volcanic zone sits above a tectonic plate boundary, where the Pacific plate is sinking beneath the northeast edge of the Eurasian plate.

The eruption of Mt. Kiliuchevskoi is only one of several volcanic events being studied by the SIR-C/X-SAR team. The radar detected evidence of recent activity at Mt. Pinatubo in the Philippines and the Rabaul Caldera in Papua, New Guinea.

Scientists hope to use such data to assist local authorities in identifying and mitigating hazards posed by these dangerous volcanoes.

"Radar images also were acquired for dozens of volcanoes around the world, including 12 of the 15 volcanoes identified by the international volcanology community as deserving special study due the threats posed to large local populations," Plaut said.

SIR-C/X-SAR, launched Sept. 30, was a joint mission of the U.S., German and Italian space agencies. The investigations are part of NASA's Mission to Planet Earth, a long-term, coordinated program to study the Earth's global environment, to observe environmental changes and to learn how human beings affect those changes.

## Hubble astronomers take big step toward finding universe age

An international team of astronomers has taken an important step toward determining the age and size of the universe, using the Hubble Space Telescope to begin clocking the cosmos' rate of expansion.

The astronomers said they have been able to calculate with considerable precision the distance to a remote galaxy, M100, in the Virgo cluster of galaxies. The ability to make accurate distance measurements over vast reaches of space will help provide a precise calculation of the expansion rate of the universe, called the Hubble Constant, which is crucial to determine the age and size of the universe.



HUBBLE SPACE TELESCOPE

This rate has been a goal of the telescope's namesake, Edwin P. Hubble, and other scientists since 1929. The Extragalactic Distance Scale Key Project is recognized as having the highest priority for observation time on the HST.

The team consists of a variety of astronomers from around the world. Dr. Wendy Freedman of the Observatories of the Carnegie Institution of Washington leads the team with Dr. Robert Kennicutt of Steward Observatory at the University of Arizona and Dr. Jeremy Mould of Mount Stromlo and Siding Spring Observatories, at the Australian National University.

"Although this is only the first step in a major systematic program to measure accurately the scale, size, and age of the universe," Freedman said, "a firm distance to the Virgo cluster is a critical milestone for the

extragalactic distance scale, and it has a major implications for the Hubble Constant."

HST's detection of Cepheids, pulsating stars used for determining distances, in the spiral galaxy M100 establishes the distance to the cluster as 51 million light-years. M100 is now the most distant galaxy in which Cepheid variables have been measured accurately. The precise measurement of this distance allows astronomers to calculate that the universe is expanding at the rate of 80 km/sec per megaparsec.

For example, a galaxy one million light-years away will appear to be moving away from us at approximately 60,000 miles per hour. If it is twice that

distance, it will be seen to be moving at twice the speed, and so on. This rate of expansion is the Hubble Constant, only one of several key numbers needed to estimate the universe's age.

"Those who pioneered the development of the HST in the 1960s and 1970s recognized its unique potential for finding the value of the Hubble Constant," Mould said. "Their foresight has been rewarded by the marvelous data that we have obtained for M100."

Using Hubble's Wide-Field and Planetary Camera, the team of astronomers repeatedly imaged a field where star formation is rich in Cepheids. Twelve one-hour exposures, strategically placed in a two-month observing window, resulted in the discovery of 20 Cepheids. About

Please see SCIENTISTS, Page 4

## New guidelines help with use or lose leave

### Compensatory time can now be extended for up to one year

By Karen Schmidt

Civil service employees can save their annual leave and compensatory time with help from guidelines prepared by the Human Resources Office and the Financial Management Division.

As the end of the year approaches, many employees have use or lose annual leave to take before year end. Human Resources Director Harvey Hartman recently announced guidelines on use or lose leave.

"It is important folks plan their leave so we can accommodate both work schedule and leave schedule," Hartman said.

Here are some guidelines to help

plan ahead. Prepare an Application for Leave (SF 71) and receive approval from management. Give to your supervisor as soon as possible so work schedules can be determined. Nov. 25 is last day to obtain approval for use or lose. Jan. 6, 1995 is last day to use this year's annual leave.

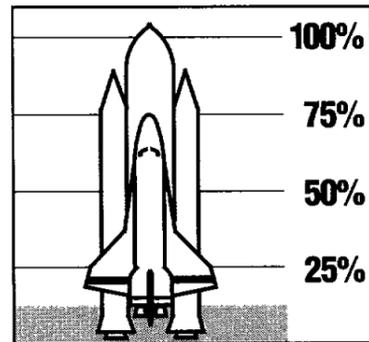
Hartman said he hopes this guide will help employees to use their leave and coordinate work activities efficiently. For more information, contact your Human Resources representative.

In a related development, the Financial Management Division recently revised the Request for Extension of Compensatory Time,

Form 1799. The new form now will accommodate up to 13 employees within the same organization and compensatory time may now be extended up to one year.

"The extension of the comp time process was changed due to modification in the NASA personnel/payroll system. The new form will provide for a more efficient method of extending comp time for employees," said Deborah Conder, chief of the Payroll, Labor and Travel Accounting Branch.

The new form may be obtained from the Information Services Division (Mail Code PS). If you need additional information, contact the Payroll Office at x34832.



1994 GOAL: \$460,500



## First airline ticket drawing goes to SR&QA worker

Compiling statistics on the Combined Federal Campaign got off to a slow start due to the flooding conditions that kept many employees at home. Seven percent of civil service employees contributed to the first week total of \$52,545.64. This is 11 percent of the goal set for JSC.

The first drawing was held for contributors to the CFC campaign. Tim Adams from the Shuttle Safety and Mission Assurance Division won a round trip Continental Airlines ticket to anywhere in the continental U.S. Drawings will be held each week for an airline ticket.

The Combined Federal Campaign runs through Nov. 18.

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# Ticket Window

The following discount tickets are available for purchase in the Bldg. 11 Exchange Store from 10 a.m.-2 p.m. Monday-Thursday and 9 a.m.-3 p.m. Friday. For more information, call x35350 or x30990.

**New Arts Six Concert:** Nov. 6 at the Grand 1894 Opera House, Galveston. Cost to attend is \$7.

**Beauty and the Beast:** Tickets are available for the Nov. 12 Walt Disney on Ice show. Cost to attend is \$11.

**The Nutcracker:** Friendswood Ballet presents The Nutcracker, 7 p.m. Nov. 4 at the Grand 1894 Opera House, Galveston. Cost to attend is \$21 special seating, \$8.40 general seating.

**Dance Company:** David Parsons Dance Company & Billy Taylor Trio will perform Nov. 12 at the Grand 1894 Opera House, Galveston. Cost to attend is \$19.

**Wurfest Bus Trip:** Nov. 5. Cost is \$20 adults, \$16 children.

**Renaissance Festival:** Festival runs from first weekend in October to second weekend in November. Cost is \$10.50 adults; \$5.25 child (7-12).

**Moody Gardens:** Discount tickets for two of three different attractions: \$9.50

**Space Center Houston:** Discount tickets: adult, \$8.75; child (3-11), \$7.10; commemorative, \$9.55.

**Metro tickets:** Passes, books and single tickets available.

**Movie discounts:** General Cinema, \$4.75; AMC Theater, \$4; Loew's Theater, \$4.75.

**Stamps:** Book of 20, \$5.80

**Upcoming Events:** Travel Fair, Nov. 1;

**JSC history:** *Suddenly, Tomorrow Came: A History of the Johnson Space Center*, \$11.

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# Gilruth Center News

**Sign up policy:** All classes and athletic activities are first come, first served. Sign up in person at the Gilruth Center and show a NASA badge or yellow EAA dependent badge. Classes tend to fill up two weeks in advance. Payment must be made in full, in exact change or by check, at the time of registration. No registration will be taken by telephone. For more information, call x30304.

**EAA badges:** Dependents and spouses may apply for photo identification badges from 7 a.m.-9 p.m. Monday-Friday; and 8 a.m.-4 p.m. Saturdays. Dependents must be between 16 and 23 years old.

**Weight safety:** Required course for employees wishing to use the weight room is offered from 8-9:30 p.m. Nov. 17 and Dec. 14. Pre-registration is required. Cost is \$5.

**Defensive driving:** Course is offered from 8:15 a.m.-3 p.m. Saturday. Next class is Nov. 19. Cost is \$19.

**Aerobics:** High/low-impact class meets from 5:15-6:15 p.m. Tuesdays and Thursdays. Cost is \$32 for eight weeks.

**Exercise:** Low-impact class meets from 5:15-6:15 p.m. Mondays and Wednesdays.

**Aikido:** Martial arts class meets from 5-7 p.m. Tuesdays and Wednesdays. Cost is \$25 per month. New classes begin the first of each month.

**Tennis league:** A Fall tennis league may be started if there is sufficient interest. Contact the Gilruth Center at x33345.

**Country dancing:** Beginners class meets from 7-9 p.m.; advanced class meets from 8:30-10 p.m. Partners are required. For additional information, contact the Gilruth Center at x33345.

**Golf lessons:** Lessons for all levels. Cost is \$90 for six weeks. For additional information, contact x33345.

**Fitness program:** Health Related Fitness Program includes a medical examination screening and a 12-week individually prescribed exercise program. For more information, call Larry Wier at x30301.

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# Swap Shop

## Property

Sale: Spacious 2x2 condo, wet bar, upstairs corner unit, all appliances incl new fam sz W/D, FPL, c'tans, \$43k. Lucky, x36198.

Rent: Condo, 1-1-1cp, W/D, kitchen appli, upstairs w/priv entrance/balcony, immed occ, \$370/mo + \$200 dep. Richard, x31488 or 286-6915.

Sale: El Dorado Trace, 2-2.5, approx 1250 sq ft, fenced patio, 2-story, tiled floors, covered parking, new AC, \$44k. 286-0520.

Sale: Sterling Knoll, 3-2-2, approx 1300 sq ft, pool, FPL, \$68.9k. 486-9760.

Sale: 3-2-2A near 290 and 1960, new roof, heat-pump, fresh paint/carpet, \$65k. x31265 or 286-3161.

Sale: Camino South, 3-2-2A, pool, FPL, new carpet, reasonable. Mike, 480-0336.

Sale: LC 3-2-2, foreclosures, \$62k/obo. James, 286-1934.

Sale: Friendswood, 3-2-2, 2583 sq ft, 1.4 acres, gameroom, pool, storage shed, \$175k. 482-1488.

Sale: '85 3-2 mobile home, gas range, dishwasher, parked in San Leon, Galveston Co, Pecan Park, \$13k. 554-2156.

Sale: Spring, TX 3-2-2, dbl atriiums, ceramic tile, cathedral ceiling, \$73,990. 326-4973.

Lease: El Dorado Trace, 1g 1 BR condo, overlooks pool, W/D, res cov pkg, mini-blinds, 2 balconies, \$425/mo + dep. Mark, 488-0056.

Sale: Alvin, 5 acres, cleared, \$22.5k. x30737.

Sale: Baywind condo, 2-1.5, 2 spaces, ground floor, W/D, new dishwasher, ex cond, immed occ, financing avail, \$33k. Tom, 333-3992.

Sale: Alta Loma/Santa Fe, 2.5 acres, mineral rights, ready to build, 337-1311.

Sale: Dickinson, mobile home space, corner lot, runners and patio, util, 50'x110', \$10.9, owner fin. 337-1311.

Sale/Lease: 3-2 waterview condo, W/D utility m, pwr boat slip w/lift, lg balcony, walk-in closets, immed occ, \$59k or \$925/mo. 326-2221.

Lease: LC, Countryside, 3-2.5-2, 2-story, lg corner lot, thick carpet, FPL, c'tans, 1800 sq ft, \$759/mo + dep. x33765 or 326-1390.

## Cars & Trucks

'85 Nissan Sentra, 5-spd, AC, 2-dr, silver/grey, 139.6k mi, \$1750. 332-2571.

'92 S-10 Ext Cab, Tahoe pkg, low mi, red/silver, \$9500. x39283.

'93 Hyundai Sonata 4-dr, auto, AC, cass, 24k mi, under warr, ex cond, \$5k/obo; '87 Nissan Maxima, PS, PW, BR, auto, AC, cass, sunroof, \$3.5k/obo. Bryant, x35033 or 451-0310.

'87 Mazda 626, gray/gray, alarm, new tires and brakes, \$4k/obo. 326-6228 or 707-9219.

'84 Ford F150 PU, auto w/O/D, AC, 140k mi, \$2800/obo. Steve, x41009 or 532-1949.

'82 Camaro Z28, copper, T-roofs, auto, body in ex cond, \$2500. 332-2697.

'78 Suburban, good working cond, lots of new parts, clean int, \$1500/obo. 540-1353.

'86 Cougar, loaded, \$2k. 998-1280.

'86 Chevy Caprice Estate Wagon, all pwr, AC, auto, recent brake/cooling, '90 Honda DX, less than 28k mi, 4 dr, AC, stereo, Roger, 790-2189 or 488-7314.

'88 Lincoln Towncar, 79k mi, \$6.3k/obo; '88 Nissan Sentra, red, 2-dr, AC, cass, 91k mi, stick, \$2.5k/obo. Walt, x47392.

'92 Mitsubishi 3000GT, 5-spd, AC, charcoal grey, 29k mi, \$18.5k; '89 Toyota 4x4 PU, 5-spd, AC, bedliner, fiberglass shell, alloy wheels, navy blue, 67k mi. \$8k. Mark, x47112.

'86 Toyota Celica GT, auto, liftbk, AC, cruise, AM/FM/cass. Tom, x40048 or 992-2166.

'93 Mazda MX-6, hunter green, loaded, std, cloth seats, ABS, moon roof, 38k mi. 486-2414.

'91 Ford XLT Supercab, capt chairs, AC, pwr, AM/FM/cass, 5-spd, 47k mi, \$12k. 486-5773.

'88 Dodge Ram 50, 5-spd, new clutch/pressure

plate, \$2.3k. Dan, x45097 or 837-8113.

'92 Chevy Silverado, whit/bk, 5-spd, V6, new tires, \$15.5k. Kathy, x36807 or 475-0975.

'85 Porsche 944, blk, 5-spd, sunroof, AC, AM/FM/cass, ex cond, \$5k. x35180 or 326-3706.

'86 Buick Electra 225, 2-dr, new paint, 90% restored, runs good. Danny, x47367.

'88 VW, not running, minor repairs, new tires, \$800. 409-765-8453.

'90 Ford Ranger XLT, \$5k. 554-2879.

'93 Chevy Ext cab C/K1500 Silverado, 19k mi, ex cond, \$15.2/obo. Eddy, x35710 or 286-2958.

'73 Triumph TR6, runs great, restored, very clean, \$4800. Dave, 474-1194.

'92 Toyota Corolla, 4-dr, 5-spd, AC, PS, AM/FM/cass, \$6.9k. Ray, x38876 or 338-1065.

'91 Ford F-150 LWB, 4.0L 6 cyl, auto pwr, AC, AM/FM/cass, \$8975 neg. 332-4548 or 282-4845.

'79 Ford Van Club Wagon, PS, PB, V8, auto, AM/FM, \$950 or trade. x36461 or 534-4667.

'86 Mustang GT w/modifications, \$4.4k. 280-0285.

## Boats & Planes

24' Sovereign, ex cond, extra jib, depth sounder, head, stove, sleeps 4, Johnson OB, \$7.9k/obo. Mike, 282-2787 or 532-1240.

'78 Wellcraft Airstar, Mercury O/B, 16 ft galv trlr, \$2k or trade, Tina, x34924 or 334-4361.

15' Wellcraft, 50hp Johnson, big wheel galv trlr, no salt water usage, garaged, good cond, \$2.4k/obo, John, 488-4487.

'89 Kenner 16', center console, 70hp Johnson O/B, ss prop, Hummingbird fish finder, Mikota troll mtr, canopy, galv, trlr, \$5.5k. Larry, x33858.

11' sailboat, needs work, \$20. x31883.

## Cycles

New Huffy Tigara 16" 10-spd bicycle, warr, was \$250, now \$150. Pat or Mike, 554-2760.

Men's Bianchi Sport SX, 14-spd bike, 25" rims, ex cond, \$100/obo. x40213 or 554-4140.

'89 Honda NX125, ex cond, runs great, \$1300. Roseann, 474-4763.

Free Spirit 12-sp bike, \$40; boy's 20" Huffy, and Free Spirit bikes, \$30 ea/obo. Fran, x40203.

## Audiovisual & Computers

Sony CD ROM drive and Soundblaster card, \$100. Mark, x30044 or 996-0981.

Delina Comm Suite 2.1, Winfax Pro 4.0, Wincomm Pro 1.1, Internet E-mail, legal, never installed or registered, \$80. Bob, x37246.

Technics 25 watt stereo receiver/amp, \$50; BSR speakers, \$25. Alex, x40290 or 992-4843.

Atari Portfolio hand-held computer, all access, \$175; Sony APM-700 speakers, 6 ohm, 160W, \$60/pair; Hansa enlarger, 6x6 and 35mm, \$100. Rick, 486-9658.

Crate bass amp, 15" speaker cabinet and Crate model 150 head, ex cond. Danny, x47367.

Amiga 500 computer, color monitor, kybd, mouse, Citizen 120D printer, SW, \$300. David, x30834 or 334-3348.

Peavey CS-800 pwr amp w/400W per channel, bi-amping, \$400. James, x33571 or 337-5583.

EV-C100 HiB VCR, \$400; EV-S3000 HiB VCR, \$950. 332-3739.

## Photographic

Darkroom equipment, enlarger w/color head, lens, digital enlarging timer, safelight, tanks, reels, trays, \$325/all. Phil, x34532 or 538-1744.

## Musical Instruments

Percussion Plus snare drum w/stand, chrome, never used, \$100. 448-2283.

## Pets & Livestock

Lg long-haired orange/white fem cat, spayed, de-clawed, 3 yrs old, tolerates baths, free. 283-9500 ext

## Today

**IMAX movie:** Space Center Houston will feature screenings of "Destiny in Space," the latest IMAX offering at 7, 8 and 9 p.m. Nov. 4. Tickets are \$5 adults, \$4 children (3-11) and seniors.

**Cafeteria menu:** Special: baked meatloaf. Total Health: lite macaroni and cheese. Entrees: baked scrod with Hollandaise, broiled chicken, pork and beef egg rolls, steamed fish, Reuben sandwich. Soup: seafood gumbo. Vegetables: stewed tomatoes, seasoned spinach, cut corn, macaroni and cheese.

## Saturday

**Trek salute:** Star Trek-themed characters will meet and greet the public from noon-6 p.m. Nov. 5 at Space Center Houston. Denise Crosby, "Lieutenant Yar" on "Star Trek: The Next Generation" will appear at 3 p.m.

## Sunday

**Trek salute:** Star Trek-themed characters will meet and greet the public from noon-6 p.m. Nov. 6 at Space Center Houston. Denise Crosby, "Lieutenant Yar" on "Star Trek: The Next Generation" will appear at 1 p.m.

## Monday

**Fire protection:** The Safety Learning Center will host a fire protection seminar from 8 a.m.-4 p.m. Nov. 7-9 in Bldg. 226N Safety Learning Center. For additional information, contact x36369.

**Cafeteria menu:** Special: Italian cutlet. Total Health: roast beef au jus. Entrees: chicken a la king, enchiladas with chili, baked lasagna with meat, steamed fish, French dip sandwich. Soup: split pea and ham. Vegetables: Brussels sprouts, oriental vegetables, buttered carrots, lima beans.

509 or 504, or 486-9605.

Cat, neutered, declawed, prefers outdoors, good conversationalist. Kim, 333-4222.

Lissa Apeo, 3 yr old male, brown, not good with children, free. Sally, x38606.

AKC Chihuahua, all shots, wormed, 4 mo old, also one parent fem, \$150 ea. 534-4667.

AKC registered Beagle pups, 6 wks, tri-color, shots, wormed, \$125. 991-3924.

## Lost & Found

Lost, women's cleats, white, on bleachers in front of Gilruth field 2, Wed, 10/5. x47528 or return to Gilruth lost and found.

## Household

Fruitwood dining room set, 6 chairs, 41x68 table extends to 105", matching 59" hutch w/glass doors/lighted shelves, \$1150. 333-8326.

Refrigerator w/ice maker, 20.6 cu ft, \$450; W/D, family sz, \$500/both; Magnavox TV/VCR, one unit, \$300. Shaw, 492-8369.

Patio furniture, round table w/umbrella, 4 chairs w/cushions, plus 2 rockers, \$250/obo. 486-1430.

Dining room table, glass top, brass base, 4 padded chairs, \$100/obo. 486-1430.

Living room chair, dk green naugahide, \$75; wood-grain formica table-desk w/letter drawer, \$35; drafting table, \$15; trundle bed w/2 mattresses, \$200; Schwinn stationary exercise bike, \$85. x30446 or 338-2625.

36" butcher block kitchen w/pedestal stand, 4 chairs w/chrome legs, cane seats, \$100/obo. x48791 or 480-7607.

Clayton Marcus qn sz sleeper sofa, ex cond, was \$900, now \$300. 996-9058.

Roll top desk w/chair, \$300; w/ht French canopy BR set, twin bed, tripple dresser, mirror, desk, hutch, chair, bed, ruffe, canopy top, \$350; w/ht French dresser, mirror, chest, \$250; Danish dining set, solid oak, 4 capitian's chairs, \$250. 332-2697.

Antique Italian DR table w/inlaid wood, drop leaf extender, 5 chairs, \$950/obo; square oak/mahogany coffee table w/2 drawers, \$200; 45 gal aquarium w/stand, \$195; Nintendo games, \$15 ea; sewing machine cabinet, \$50. Marie, 992-5535.

Natural wood Simmons baby bed w/mattress, comforter, bumper pads, \$175/all or sell separate; elec dryer, good cond, \$100. 997-0756.

Hunter green/peach easy chair, \$40; brown tweed recliner, \$40; 2 table lamps, \$5 ea; bk end table, \$5 or \$75/all. x34772 or 286-0219.

Oak coffee table, \$30; hexagonal fold-up wood/ felt poker table, needs work, \$20. Alex, x40290 or 992-4843.

Kg sz bed w/storage hdbd, \$600. 474-7432.

Solid oak dresser and mirror, ex cond, \$250; qn sz, deluxe bed frame, \$15. 332-2671.

Forest green leather couch and chair, pine coffee and end tables, \$900; French country dining table w/4 chairs, \$250. 477-5414.

Antique solid oak table, 48"x48", ex cond, \$350; Starlyte briefcase, \$20. 488-5564.

Boy's BR furniture, all wood, dresser, desk, 2-dr cabinet, corner unit, 2 hutches, good cond, \$225. Donna, 286-4255.

Brass qn sz bed/frame, \$450; 20" lawn mower, \$25; Weed Eater, 5hp rear-tine tiller, \$450; gray marble 12"x12" tiles, 250 sq ft, or \$3/sq ft; adjustable bed frame, \$10. 997-2280.

Zenith 25" color console TV w/remote, \$310/obo; 4-head VHS w/remote, \$140/obo; microwave oven, \$130/obo. Walt, x47392.

Antique buffet, English, \$250; 6'x4' oak veneer bookcase, \$160; 357 magnum revolver, made in Germany, 6" barrel, single action. Rick, 486-9658.

Early American pine furniture, sofa, recliner, chair, tables, bar stools, bunk bed, twin bed, shelves, mirrors, wall hangings, wagon wheel fixtures; dining table w/leaves, 6 chairs; kitchen table w/6 chairs. 474-3507.

## Tuesday

**AIAA seminar:** The Houston Section of the American Institute of Aeronautics and Astronautics will host an "Internet seminar" at 7 p.m. Nov. 8 in the Hess Room at the Lunar and Planetary Institute. For information, contact Naz Bedrossian, 333-2127 or Bill Best, 282-6970.

**Cafeteria menu:** Special: stuffed cabbage rolls. Total Health: roasted turkey. Entrees: turkey and dressing, country style steak and hash browns, beef ravioli, baked chicken, French dip sandwich. Soup: tomato Florentine. Vegetables: Italian blend, okra and tomatoes, corn coblette, navy beans.

## Wednesday

**Astronomy seminar:** The JSC Astronomy Seminar will meet at noon Nov. 9 in Bldg. 31, Rm. 129. Deborah Dominique of LPI will discuss "UV Observations of the Galilean Satellites." For more information, call Al Jackson at 333-7679.

**Toastmasters meet:** The Spaceland Toastmasters meets at 7 a.m. Nov. 9 at House of Prayer Lutheran Church on Bay Area Blvd. For additional information, contact Darrell Boyd, x36803.

**Cafeteria menu:** Special: pepper steak. Total Health: stir fry pork with rice. Entrees: liver and onions, catfish and hush puppies, stir-fry pork with rice, steamed fish, Reuben sandwich. Vegetables: steamed broccoli, yellow squash, macaroni and cheese, vegetable sticks.

## Thursday

**Sigma Xi:** The NASA-JSC Club of Sigma Xi, the Scientific Research Society, will host a meeting beginning at 5:30 p.m. Nov. 10 in the Forest Room at the University of Houston, Clear Lake. James Lester will discuss "The Scientific Challenges to Sustainable Development: Examples from

the Gulf of Mexico." Cost is \$10 members, \$11 non-members. For reservations and additional information, contact Ruth Ann Morrison at 283-3815.

**Cafeteria menu:** Special: chicken fried steak. Total Health: fat-free vegetable soup. Entrees: beef tacos, scrod with Hollandaise sauce, steamed fish, French dip sandwich. Soup: navy bean. Vegetables: spinach, cut corn, breaded okra, pinto beans.

## Friday

**Veterans Day:** Most JSC offices will be closed in observance of the Veterans Day Holiday.

**Trek salute:** A Star Trek Movie Marathon will be held in Space Center Houston Theater beginning at 6:30 p.m. Nov. 11. Admission is \$10. Reservation deadline is Nov. 9. For additional information and reservations call 244-2140 or 244-2142.

## Nov. 12

**Trek salute:** Star Trek-themed characters will meet and greet the public at Space Center Houston from noon-6 p.m. Nov. 12. John DeLancie, who portrays "Q" on "Star Trek: The Next Generation" will appear at 3 p.m.

## Nov. 13

**Trek salute:** Star Trek-themed characters will meet and greet the public at Space Center Houston from noon-6 p.m. Nov. 13. John DeLancie, who Portrays "Q" on "Star Trek: The Next Generation" will appear at 1 p.m.

## Nov. 16

**Astronomy seminar:** The J

# Liquid Eye Stares into Night Sky

## JSC-built telescope uses liquid mercury mirror to scan for orbital debris

By Eileen Hawley

Scientists at JSC have developed and built a unique tool for observing and measuring orbital debris—a telescope that uses liquid mercury to form a thin, reflective surface.

The 3-meter diameter of its primary dish makes JSC's telescope the largest telescope of any kind in the state of Texas, and the 17th largest in the world. The telescope currently is located in Bldg. 268A, but work is under way to dismantle it and move it to New Mexico.

"Houston is not a good place for astronomical observations because the skies are often cloudy and there is so much light," said Drew Potter, chief of the Space Science Branch of Space and Life Sciences.

Because of that, the telescope is being carefully packed for a trip to Cloudcroft, N.M., where it will take up residence in an abandoned Air Force Tracking Station facility. Over the next two years, under a contract with the National Science Foundation and the Associated Universities for Research in Astronomy, the telescope will be used to gather data on the orbital debris environment.

The abandoned Air Force facility has been vacant for about 10 years and is now the property of NSF, according to Project Manager Glen Cress. The building has been renovated and is ready for JSC's telescope.

"It's a big facility," Cress said. "It is about 75 or 80 feet tall with a rotating dome. And Cloudcroft's clear skies and distance from city lights will further enhance our observations."

Once the telescope is relocated and

reassembled, some additional work will be required before observations begin. Cress hopes data-gathering activities will resume in early summer.

Liquid mercury telescopes typically are not used by the astronomical community since they cannot be steered. The liquid mercury telescope functions much like the Haystack radar used by NASA to monitor orbital debris in low Earth orbit (see Space News Roundup, Aug. 26, 1994), "staring" at a particular slice of space and observing objects that pass through that area.

Using this "staring" mode, the telescope can observe any object that passes through its field of view—an area of about .35 degrees (or about two-thirds as wide as the moon when viewed from Earth.)

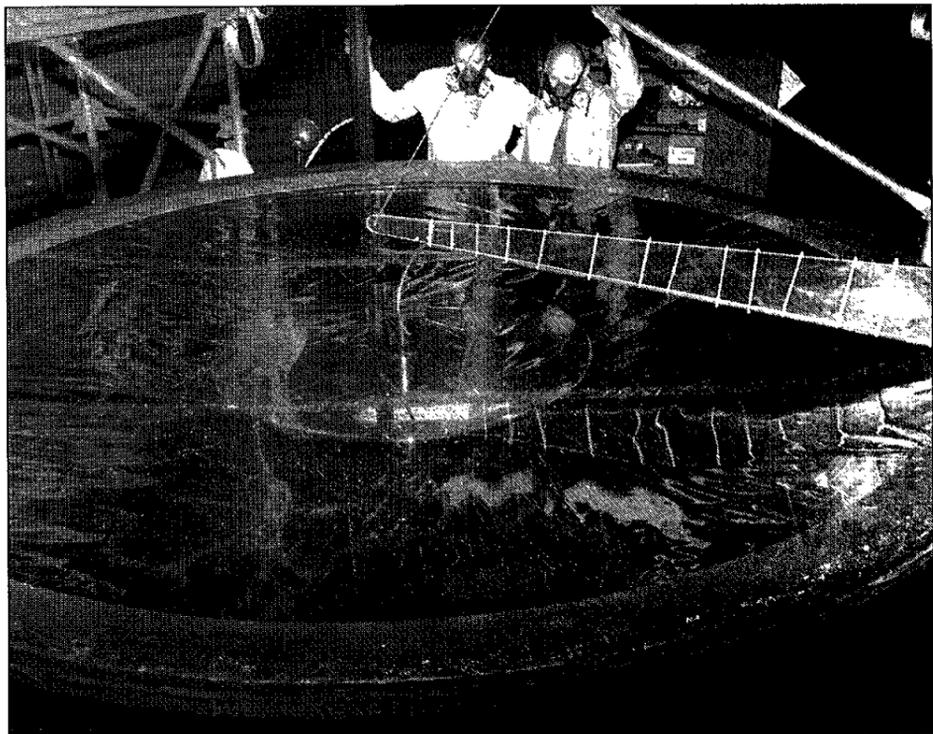
According to Cress, most orbital debris studies are done using radar rather than telescopes, but telescopes do offer some advantages.

"Telescopes are less expensive to operate than radar," Cress said. "And with telescope observations, we can observe small objects in geosynchronous orbit where radar is restricted to observing debris objects in low and middle Earth orbits."

The disadvantage to telescope observations, Cress said, is the need for dark, clear skies.

"Using a telescope, we are limited to about 1-2 hours of observation time after sundown and before sunrise because we need sunlight reflecting off the debris to be able to see it," Cress said.

The studies with this telescope will complement those being made using the Haystack radar. Comparing those two sets of



Mark Mulrooney, (left), and Frank Gibbons of Lockheed, fill the telescope dish with liquid mercury. The two researchers wear protective clothing and breathing apparatus to protect them from potentially harmful mercury vapors. Mulrooney and Gibbons used about 600 pounds of the dense mercury to fill the dish earlier this year before operations began. A plastic "ladder" mechanism was used to help pour the mercury into the dish. The mercury is pooled in the center of the dish and covers about one-third the dish diameter when the dish is stationary.

data will give researchers a better understanding of the orbital debris environment, knowledge that is important for orbiting spacecraft, including the planned International Space Station.

The development of JSC's three-meter telescope was driven by two factors—the need for an instrument that could develop a statistical profile of orbital debris in low and middle Earth orbits as well as in geosynchronous orbit, while remaining cost-effective.

The answer, according to Potter, was to use liquid mercury instead of glass to function as the telescope's "mirror."

"Our telescope has very good optical quality at a significant cost savings over a mirror telescope," Potter said. "We built this telescope over the past couple of years at a cost of about \$400,000. A similar-size telescope using a glass mirror would cost about \$10 million."

The telescope consists of a parabolic dish with a diameter just over three yards that holds several gallons of liquid mercury that pools in the center of the dish. To use the telescope, the dish is spun up to a rate of 10 revolutions per minute. Centrifugal force and surface tension then cause the liquid mercury to spread out in a thin layer over the dish creating a reflective surface that is as good as any polished glass mirror.

"The real key to operating this telescope is the air bearing the dish rests on," said Cress. "This is the real technology breakthrough of the past few years, because the dish has to be extremely stable to form a usable reflective surface."

Several challenges were overcome in the development and use of the liquid mercury

telescope, including the mercury's own chemical properties. According to Dowis Atkins of JSC's Environmental Health office, liquid mercury vapors can be hazardous.

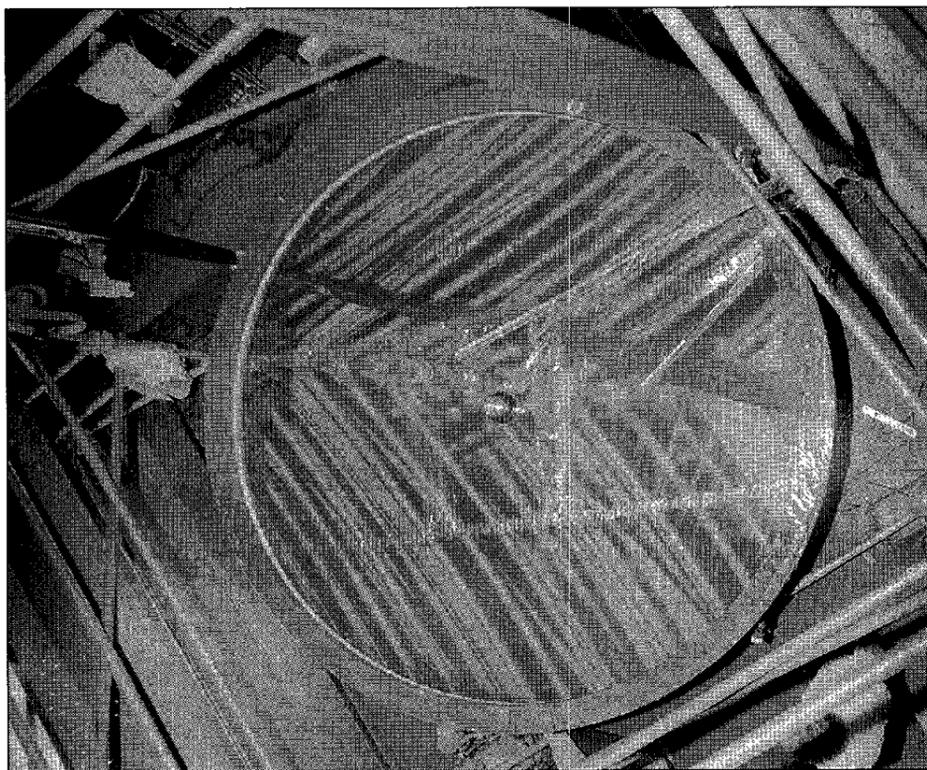
"Because mercury is a liquid, it vaporizes into the air where it can be inhaled," Atkins said. "Once inhaled, it moves directly into the bloodstream and body, and may affect the central nervous system." As a result, the researchers observe a number of precautions when working with liquid mercury. Procedures are in place for spills and safety processes.

The telescope is covered when not in use and vapor monitors located inside the Bldg. 268A silo constantly measure the liquid mercury vapor levels. When researchers enter the silo to prepare the telescope for use, they wear gas masks with air filters to protect them from the vapors.

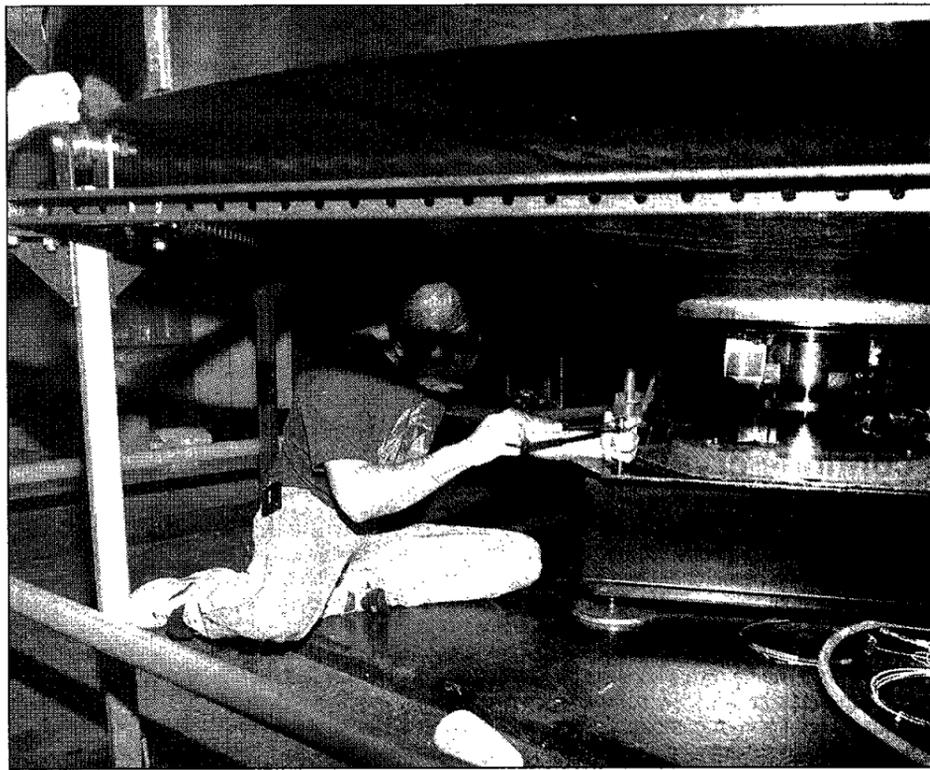
"When the dish is stationary, the mercury pools in its center and a mercury oxide coating forms on the surface," Cress said. "That coating is skimmed off by technicians wearing protective breathing gear and clothing."

Technicians remain in the building only long enough to prepare the dish and begin it spinning so that the mercury will fan out to create the reflective surface. Once the surface is established, the researchers would leave the building to collect data in trailers located outside the silo. Similar procedures will be followed in the Cloudcroft facility.

The telescope is set to be transferred to the new facility in early December. Installing the telescope in its new home will take two to three months, followed by some calibration and checkout activities. Observations will resume in early summer. □



As the three-meter telescope spins at a rate of 10 revolutions per minute, the mercury has fanned out to create a smooth, reflective surface. The telescope dish is covered with a protective sheet of plastic in this image, but the silo's scaffolding is clearly reflected from the mirror-like mercury surface. The protective covering is removed when the telescope is used for observations, but remains on the dish when it is not in use to protect technicians and researchers from the mercury vapors.



Technician Freeman Bertrand works to level the telescope's parabolic dish prior to spinning operations. The air bearing sits on top of an I-beam base. The air bearing must be completely level before the dish spins. If the dish is not completely level, the mercury will "tear" and a continuous, smooth surface can not be established.

## Space Center Houston beams up 'Star Trek' this month

Since its arrival in the mid-60s, the crew of the Starship *Enterprise* has entertained millions of viewers in the legendary television series "Star Trek." Now, "trekkers" all over the Houston area can "beam down" to Clear Lake and experience "Salute to Star Trek" month during November at Space Center Houston.

Encompassing four weekends, Star Trek month will feature celebrity appearances from former and current cast members, who will sign autographs on specially designed, commemorative "Star Trek" cards. Star Trek-costumed characters will greet guests from 12-6 p.m. each weekend. Friday night activities will

include screenings of "Destiny in Space," narrated by Leonard Nimoy, and a Nov. 11 movie marathon including all six "Star Trek" feature films.

Drawings will be held all month long with winners receiving special "Star Trek" items ranging from action figures to a genuine cast and crew suede jacket. A grand prize drawing will be held on Nov. 26, with the lucky winner receiving a vacation to Los Angeles and a walk-on role in an upcoming episode of "Deep Space Nine." The public can register for the grand prize drawing during the entire month both at Space Center Houston

and all Houston area Jack in the Box locations.

The activities begin today with 7, 8 and 9 p.m. showings of "Destiny in Space." The IMAX feature will be presented at the same times every Friday, except Nov. 11 and 12, when a Star Trek Movie Marathon will run from 7 p.m. to 7 a.m.

Denise Crosby, "Lieutenant Yar," will appear at 3 p.m. Saturday and 1 p.m. Sunday.

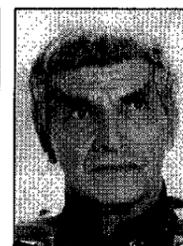
John DeLancie, "Q," will appear at 3 p.m.



Crosby



DeLancie



Lenard

Nov. 12 and 1 p.m. Nov. 13.

Mark Lenard, "Sarek," Spock's father, will visit at 3 p.m. Nov. 19 and 1 p.m. Nov. 20.

Walter Koenig, "Chekov," will beam down at 2 p.m. Nov. 26 and 1 p.m. Nov. 27.

## MCC open for viewing

The Mission Control Center viewing room will be open to JSC and contractor badged employees and their families during portions of the STS-66 mission.

Based on a Thursday launch, employees will be allowed to visit the MCC from 11:30 a.m.-2:30 p.m. today.

The MCC also will be open from 1-5 p.m. Sunday; from 11:30 a.m.-2:30 p.m. Monday, from 11:30 a.m.-2:30 p.m. and 5-7 p.m. Wednesday, and 1-5 p.m. Nov. 13. There will be no scheduled viewing hours on Nov. 14 due to the planned landing.

Employees must wear their badges and escort family members through the regular public entrance on the northeast side of Bldg. 30. Children under 5 will not be permitted. No flash photography or loud talking will be permitted at any time.

Because of the dynamic nature of shuttle missions, viewing hours may be changed or canceled without notice. For the latest information on the schedule, call the Employee Information Service at x36765.

## Small business expo features station facts

Small, disadvantaged and women-owned businesses may discuss their companies' capabilities with JSC's major support contractors and technical organizations at an upcoming Small Business Expo.

The free expo, from 9-2 p.m. Nov. 18 at the Gilruth Center, will include the first in a series of International Space Station Alpha symposia. This introduction will include a detailed technical briefing with information about procurement opportunities.

Educational briefings conducted by the JSC small business specialist, the Texas Information Procurement Service and the Small Business Administration will be offered all day.

For more information, contact Barbara Kirkland at x34512.



**FLOOD RELIEF—NASA Exchange Manager Teresa Sullivan, left, and volunteer Carolyn Perkins, center, help a JSC employee carry donations into the Gilruth Center gymnasium as part of last week's Employee Activities Association-sponsored drive to gather items for victims of the recent Houston-area floods. Ginger Gibson, who worked with Sullivan to coordinate the drive, said a steady stream of donors brought items ranging from food and canned goods to clothing and cleaning supplies during the Oct. 28 drive. The items collected were given to JSC employees who were victims of the flood. The remainder of the donations were taken to the United Way offices on Egret Bay for distribution to other Houston flood victims.**

JSC Photo by Benny Benavides

## Holidays to affect Roundup deadlines

Because of the Thanksgiving and Christmas holidays, Space News Roundup will not be published Nov. 25 or Dec. 23.

These changes will affect some deadlines.

The deadline for Swap Shop ads and Dates and Data calendar items for the Nov. 18 issue will be 5 p.m. Wednesday, Nov. 9. The deadline for ads and calendar items for the Dec. 2 issue will be Nov. 18.

Around Christmas, the deadline for Swap Shop ads to be published in the Dec. 30

Roundup will remain unchanged, 5 p.m. Dec. 16. The deadline for Dates and Data items for that issue also will be 5 p.m. Dec. 16.

The deadline for Swap Shop ads for the Jan. 6 issue will be 5 p.m. Dec. 23. The deadline for Dates and Data items for that issue will be 5 p.m. Dec. 28.

All ads and calendar items will be published on a space-available basis, first come, first-served. Any ads that cannot be published will be discarded and must be resubmitted.

## Scientists use HST to measure distance to Cepheid variable star

(Continued from Page 1)

40,000 stars were measured in the search for these rare, but bright, variables. Once the periods and intrinsic brightness of these stars were established from the careful measurement of their pulsation rates, the researchers calculated a distance of 51 million light-years to the galaxy.

M100 is now the most distant galaxy in which Cepheid variables have been discovered. The Hubble

team emphasized that the project must link into even more distant galaxies before a definitive number can be agreed on for the age and size of the universe. This is because the galaxies around the Virgo Cluster are perturbed by the large mass concentration of galaxies near the cluster. This influences their rate of expansion.

These first HST results are a critical step in converging on the true value of the Hubble Constant.

Hubble found that the farther a galaxy is, the faster it is receding away from us. This "uniform expansion" effect is strong evidence the universe began in an event called the "Big Bang" and that it has been expanding ever since.

To calculate accurately the Hubble Constant, astronomers must have two key numbers: the recession velocities of galaxies and their distances as estimated by one or more cosmic "milepost," such as

Cepheids. The age of the universe can be estimated from the value of the Hubble Constant, but is only reliable as the accuracy of the distance measurements.

The Hubble Constant is only one of several key numbers needed to estimate the universe's age. The age also depends on the average density of matter in the universe, though to a lesser extent.

A simple interpretation of the large value of the Hubble Constant, as

calculated from HST observations, implies an age of about 12 billion years for a low-density universe, and 8 billion for a high-density universe. However, either value highlights a long-standing dilemma. These age estimates for the universe are shorter than the estimated ages of some of the oldest stars found in the Milky Way and in globular star clusters orbiting our Milky Way. Small age values pose problems for current theories about the universe.

## STS-66 astronauts will test heat pipes, continue crystal growth experiments

(Continued from Page 1)

While the ATLAS payload and the CRISTA-SPAS satellite study the atmosphere for researchers gathered at the Marshall Space Flight Center, Clervoy will spend the next five days operating a Heat Pipe Performance experiment. The hardware consists of 10 heat pipes in the crew compartment, a control-motor module and supporting electronics needed for the evaluation of the thermal and fluid dynamics of heat pipes in microgravity. Almost three dozen different tests will be conducted during the experiment. This is the second test of the Heat Pipe Performance hardware, coming in the wake of initial work

conducted on STS-52 in 1992.

In addition to their other chores, Parazynski and Tanner will be monitoring the work of a pair of Protein Crystal Growth experiments in *Atlantis*' middeck area during the next week and a half and Tanner will conduct daily checks on ten rodents in special cages in the middeck which are part of a National Institutes of Health experiment to gather additional information about the effect of microgravity on living organisms.

After a week and a half in orbit, *Atlantis* is scheduled to glide to an early morning landing at the Kennedy Space Center to wrap up the seventh and final shuttle mission of 1994.

## Space News Roundup

The Roundup is an official publication of the National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Texas, and is published every Friday by the Public Affairs Office for all space center employees.

Dates and Data submissions are due Wednesdays, eight working days before the desired date of publication.

Editor ..... Kelly Humphries  
Associate Editor ..... Karen Schmidt  
Associate Editor ..... Eileen Hawley

## 'Tis the season for EAA Christmas dinner, dance tickets to go on sale

Better not cry, better not pout, tickets to the Employee Activities Association annual Christmas Dinner/Dances are almost out.

They'll go on sale at 8 a.m. Nov. 15 in the Bldg. 11 cafeteria.

This year, four different bands will perform in two different rooms at the Gilruth Center on two nights.

The evening of Dec. 9, "Jimmy Luke & the Midnite Flyer Band" will play real Texas rhythm and blues with horns in the ballroom, and the "Quick-Get-Away Band" will play country/southern rock in the gym.

On Dec. 10, "Rhythm Mission Band" will perform swing, big band,

bossa nova, jazz, and easy listening in the ballroom while "Toonz Band" will play classic rock in the gym.

Social begins at 7:30 p.m. and a dinner of prime rib will be served at 8 p.m.

Tickets cost \$22.50 per person and are non-refundable. Badged NASA and contractor employees, and NASA retirees may purchase one table of either 6, 8 or 12 seats. This year's flyer includes a map of table placements to help party-goers pick their spots. Ticket sales close at 2 p.m. Dec. 7.

For additional information contact Mavis Ilkenhans at 244-9644.